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For: Robust, Low-Resistance Elastomeric Conductive Polymer Interconnect

1. An elastomeric device for electrically interconnecting two or more components, comprising,

an elastomeric matrix having one or more outer surfaces; and

one or more electrically conductive pathways through said matrix, wherein at least a portion of the electrical pathway contains a material that is an electrically conductive liquid at the elastomeric device's operating temperature.

2. The device of claim 1, further comprising one or more electrically conductive contact pads, wherein at least a portion of said pad is in electrical contact with one or more of said pathways.

3. The device of claim 1, wherein the electrically conductive liquid is a low melting point metal or alloy.

4. The device of claim 3, wherein said metal is Gallium.

5. The device of claim 3, wherein said alloy contains one or more metals selected from the group of metals consisting of Gallium, Indium, Bismuth, and Tin.

6. The device of claim 1, wherein said pathways are anisotropic and comprise between about 2 to 50% magnetic particles by volume of said elastomeric matrix.

7. The device of claim 1, wherein said matrix comprises one or more elastomers which retains most of its elasticity over a temperature range of between at least 20° C to 75° C.

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8. A method for making an elastomeric device for electrically interconnecting two or more components, comprising the steps of:

embedding a plurality of magnetic particles, coated with a low melting point metal or alloy, in an elastomer by mixing the particles in the elastomer before the elastomer sets;

applying a magnetic field to the particles so that the particles align themselves in electrically isolated columns;

heating the matrix sufficiently to fuse the low melting point coating; and

polymerizing the elastomer to form an elastomeric matrix having one or more outer surfaces and comprising one or more electrically conductive pathways through the matrix.

9. The method of claim 8, wherein the uncured elastomer is coated on a carrier that contains conductive pads.

10. The method of claim 8, wherein the uncured elastomer is coated on a carrier that contains one or more metal layers, the method further comprising the step of creating one or more electrically conductive pads that are electrically continuous with at least one electrically conductive pathway through the matrix.

11. An elastomeric device for electrically interconnecting two or more components, comprising a matrix of electrically insulating elastomer that retains most of its elasticity over a temperature range of at least 20°C to 75°C, containing an array columns that are electrically conductive liquid over at least the upper range of the use temperature of the device.

12. The device of claim 11, further comprising one or more electrically conductive contact pads in electrical contact with said columns.

13. A method for making an elastomeric device for electrically interconnecting two or more components, comprising the steps of:

creating an array of low melting point metallic columns on a carrier; and

laterally encapsulating said array in an electrically isolating elastomeric matrix.

14. A method for making an elastomeric device for electrically interconnecting two or more components, comprising the steps of:

creating an array of openings in an electrically isolating elastomeric matrix; and

filling the openings with a material that is an electrically conductive liquid over at least the upper range of the use temperature of the device.

15. An elastomeric device for thermally interconnecting two or more components, comprising a matrix of electrically insulating elastomer that retains most of its elasticity over a temperature range of at least 20°C to 75°C, containing an array of columns that include thermally conductive liquid metal over at least the upper range of the use temperature of the device.